Trading behavior and firm-specific characteristics during the crash of 1987

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Trading Behavior and Firm-Specific Characteristics During the Crash of 1987: Evidence from the Netherlands

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SUMMARY. The October 1987 crash was a worldwide event. All the major stock exchanges in the world declined significantly on Monday, the I9ih and Tuesday, the 20th of October. Financial economists have been trying to explain this sudden decline. In this paper, we examine a few issues wilr respect to the effects of the crash. First, we look at the major determinants of stock return and test the existence of any panic behavicr and overreaction. Second, we look at the behavior of option returns during the crash period. Third, we analyze the daily trading volume behavior of individual stocks. And fhally, we test an investment strategy to make use of the overreaclion behavior of the market to "make money."

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The October 1987 crash was a worldwide event. All tie major stock exchanges in the world declined significantly on Monday, the 19th and Tuesday, the 20th of October. For example, in the Netherlands, the CBS Tendency Index-an unweighted average of most active shares traded on the Amsterdam Stock Exchange-went down almost 9.5% on October 19, and dropped another 4.6% on the following day. This can be compared with Standard & Poor's 500 Stock Index in the United States which declined 20.5% on October 19, aid increased by 5.3% on October 20.

Financial economists have been trying over the past years to expkin this sudden decline. Several studies on the impact of the crash have been published including international comparison of the reaction of stock market indices and an analysis of the behavior of individual stock returns. TheBrady Commission Report of 1988 in the U.S. cites index arbitrage and portfolio insurance as primary reascns for the sharp decline in stock prices. Many researchers do not share this feeling, and suggest that the crash was caused rather by fundamental factors such as a sudden realisation of tower expected returns, upward revision of required returns, etc.

Kyle (1988) puts forward three competing explanatiors for the crash: information shock, selling pressure and too few buyers, and supports the last two factors. Mitchell and Netter (1989) suggest that the 10% decline in the U.S. during October 14-16 nay have triggered the crash. They show lhat proposed changes in UK tax rule regaiding leverage buyout (nordeductibility of interest costs) contributed to this pre-crash decline. Roll (1988) disagrees with the widely-expressed view that the U.S. stock market pulled down all the othei markets on October 19. He attributes the crash to the normal response of each country's stcck market to a worldwid: market movement. This international comparison was extended and confirmed in the work of Bertero and Mayer (1990). In explaining the crash, Amihud, Mendelson and Wood (1990) argue that the lack of liquidity associated with an increased bid-ask spread anc reduced market depth in the stock market contributed to the decline of stock prices. The dramatic drop in share prices also coincides wkh a huge increase in volatility. Schwert (1990) finds that volatility is high durirg periods of stock market decline and that it gradually falls

back to normal levels. In the case of 1987 in the U.S., the peak was higher than usual, and the decline was more rapid.

The October crash has also drawn attention to issues surrounding the relationship among different securities markets. The integration of the stock, futures, and options market during the crash is analyzed by Miller (1991) and Kleidon and Whaley (1992). By analyzing the relationship between index futures and the underlying cash market, Miller found that the two markets were disconnected on October 19. The results of Kleidon and Wialey suggest that although the usual links between futures and options markets remained largely intact, both of these markets showed breakdowns with the cash market. The crash has also led to a significant change in international stock market Linkages. Arshampalli and Doukas (1993) report that the degree of interdependence between major European stock markets and the U.S. stock market has increased substantially since the crash of October 1987.

Studies of stock returns in the crash indicate that market participants showed panic behavior (Ferguson, 1988). Markets seemed to overreact on the first day while correction took place on the following days. The overreaction occurs also on an individual securities level, where securities that declined more or less than the average adjusted toward the mean the following d»y. Greenwald and Stein (1991) report that in the last hour of trading on the New York Stock Exchange (NYSE) on October 19, heavy selling volume pushed prices down approximately 12%, resulting in an overall market decline of more than 20% for the day. Because of the large number of overnight buy orders, the market opened up on October 20 about 12% above Monday's close.

One interesting characteristic of the Amsterdam Stock Exchange (ASE) is that it was one of the few European exchanges that remained open when the crash in the New York Stock Exchange started at 9:30 a.m. New York time (3:30 p.m. in Amsterdam). Due to the time-zone difference, the ASE always opens before the NYSE. Thus, it was possible for the ASE to lead in different phases of the crash. The 12.6% decline of the CBS Tendency Index on the ASE between 10:00 a.m. and 3:30 p.m. (before the opening of the NYSE) was ahead of ihe decline in the NYSE. Tkis, however, could have been a response to the U.S. decline of 10.5% during October

14-16. On the other hand, the 20%> decline in the S&P 500 index in the NYSE on the 19th of October was followed by a 9% cvemight decline of the CBS index on the ASE. The correction of the U.S. market on the 20th (5.3%) was preceded by an 8.6% increase between 10 a.m. and 3:30 p.m. on the same day on the ASE Finally, the overnight return of October 21 on the ASE (4.2%) could have been £ response to the U.S. **market's** reaction on the previous day, i.e., October 20 (5.3%) or a prediction of the U.S. market for the **following** day, i.e., October 21 (9.1%). The difference between the closing prices of October 19 and the opening prices of October 20 (i.e., overnight return) can be viewed as the direct impact of the crash in the U.S. The intraday behavior of prices on Tuesday, October 20, from open to close reflects more independent evaluation of the stock market by traders in Amsterdam.

The crash also had a significant impact on the increased trading activity which may reflect increased uncertainty and **diverse** expectation of market participants. Turnover of shares on the Amsterdam Stock Exchange on October 19 was three times the average daily turnover for the first nine months of 1987. On the 20th of October, it was even four times the average. The significant increase in volume of trade on October 19, which occurred before the crash in New York, indicates that there have been other factors which increased uncertainty in the Amsterdam Stock Exchange. This increased volume of trade is consistent with findings seen in other **stock** markets (e.g., Ben-Zion et al., 1990).

In this paper, we investigate a few issues with respect to the effects of the crash on the Amsterdam Stock Exchange. First, we look at the major determinants of the decline of different stocks during the crash. Second, we look at the behavior of **returns** of call and put options for all underlying Dutch stocks. The use cf options may be of particular interest since, for any given change in the price (return) of stocks, the change in option prices are much more significant. Third, we analyze the daily trading volume behavior of individual stocks during the crash period, and last, we test a possible strategy to make use of the oveireaction behavior of the market to "maks money."

The remainder of the paper is **organized** as follows: in section I, a brief discussion of the Amsterdam Stock Exchange is provided; in section n, we discuss possible determinants of stock return and trading volume; in section ID, we present our model; section IV describes the data; section V presents the empirical results; section VI develops an investment strategy and report! the findings; and section VII concludes and summarizes our results.

/. *AMSTERDAM STOCK EXCHANGE*

The Amsterdam **Stock** Exchange is the only stock exchange operating in the Netherlands. Trading takes place mostly on the official market and the official parallel market. The official market is the first-tier market for listing of relatively large companies. The parallel market is operating since 1982 with the lira to enable small and medium companies to trade publicly. In addition, there is an over-the-counter market to trade securities which are not officially listed.

Until 1985, most securities were traded on the basis of one price fixed at the end of first or/and second round of dealing. But since then all securities are traded and quoted continuously. Each transaction on the Exchange is executed by a "hoeknun" who until July 1990 worked with fixed commissions. A "hoeknian" is comparable with a "specialist" of the New York Stock Exchange, with the following major difference: for each share, there are more than one "hoekman." The "hoekman" is assigned responsibility for the trading in a certain stock, but does not have the obligation to make a market. He will trade for his own account only to keep the market liquid.

The trading system on the ASE can be characterized as an order-driven system. All orders, whether buy or sell, arrive through brokers with the "hoeknran," and are first matched and then executed at one single price. Tie price is fixed in such a way that maximum number of buy and sell orders can be satisfied. No bid or ask price can be distinguished. The Stock Exchange operates on a cash basis; forward trading is no! customary in the **Netherlands**. An automated information system *las* been installed in 1988 thus making electronic contact among the members possible. Tke system provides trade information and business data only to stockbrokers, the trading floor and the securities clearing system. There is no seat

system on the Exchange. Anybody satisfying all set requirements (minimum capitalization, independence and skill) is eligible for membership.

There were 564 companies listed on the Exchange in 1992 with more than 1600 different securities officially traded. Almost 60% of these securities were domestic aid foreign bonds. Close to 45% of the shares were foreign (mostly American) shares. The market value of all Dutch common shares listed on the ASE at the end of 1992 amounted to almost 300 billions of guilders. The ten largest firms account for around two-thirds of total stock market capitalization, vith one firm-Royal Dutch Petroleum-making up almost one-third and another firm-Unilever-making up almost 13%. Total tradirg volume of shares has increased from 121 billions of guilders in 19S8 to 156 billions in 1992. Shares of international companies and investment institutions account for 33% and 17% respectively, of the effective turnover on the Stock Exchange. The estimated shares of individual investors, institutional investors and foreign investors in total share turnover in 1992 were 20%, 25% and 51%, respectively.

//. *DETERMINANTS OF STOCK RETURN AND TRADING VOLUME*

Stock Return

Empirical studies of stock markets suggest that individual stock returns follow a simple market model,

$$R_{it} = a_i + b_i * R_{mt} + u_{it},$$

where, /?„ and R_{mt} are the return in period t of security i and the market, respectively, b_i is the systematic risk measure of security i, and *un* is the non-systematic random factor in period f. In efficient markets, u_{it} is not serially correlated (i.e., we expect $Cov(u_{i,t}, un\text{-}i) = 0$ and $Cov(R_{i,t}, R_{i,t-1}) = 0$).

According to the Capital Asset Pricing Model (CAPM), additional factors, other than the systematic risk measure, are not very relevant in explaining the daily return of a security. However, in a

situation of panic behavior, the beta factor may not be the only explanatory variable. One relevant variable in panic behavior is the liquidity of the security since investors first try to get rid of their liquid risky assets (e.g., Grossman (1989), Lauterbach and Ben-Zion (1991)). Some possible proxies for the liquidity of a security could be firm-size 01 its market value. Another characteristic of panic behavior is the overreaction phenomenon of the market. By trying to get rid of a security at any price (no limit orders) some prices drop too much, while others drop too little. Thus, we may find price reversal and correction on the following day.

An additional test of the relationship between the ASE and other international stock exchanges can be made using securities which are cross-listed on the Amsterdam and foreign exchanges. Because of the time zone difference, it is interesting to compare stock exchanges where the hours of trade are not fully overlapping. For this reason, one can compare the ASE with the New York and Tokyo exchanges by using securities which are cross-listed in two exchanges. In this paper, we focus our attention on Dutch stocks listed on the ASE, and also consider a sub-category of these stocks listed on U.S. exchanges.

Another relationship which is used in the literature on "bubbles" in a stock market is the relationship between the accumulated rate of increase in stock prices in the pre-crash period and the decline in the crash period. Telser (1989) and Roll (1989) find empirical support for a speculative bubble burst in October 1987, while Miller (1991) views the period of prolonged price increase before October 1987 and then the sharp break as entirely rational. Since the nine-month increase on the ASE before the crash was only 2.3%, we do not expect an overall bubble phenomenon.

Trading Volume

Trading takes place due to changes in liquidity needs and release of information. Research on trading activity suggests that it can increase because of tlie heterogeneous interpretation by investors of a given information release. It increases also vith identical interpretation of information but with diverse prior expectations (Karpoff (1986)). Panic behavior during a market crash will normally lead to a large volume of sell orders with no price limit.

Selling pressure is expected to concentrate initially in larger and more liquid securities. When market volatility increases with crash, trading volume could be higher than normal, and this can continue as lorg as uncertainty remains. It should be noted, however, that a significant part of the decline in Amsterdam, which is normally attributed to the second day, w£s actually the change between the closing price of October 19 anc the opening price of October 20. This change in stock prices occurred in the absence of any trade. Karpoff (1987) considers the absolute magnitude of return as one determinant of the volume of trade. A similar approach was undertaken by Ben-Zion et al. (1990).

///. THE MODEL

In this section, we formulate an econometric model which is estimated by using linear regression. We use both return regressions and volume regressions. First, we present the model for retirns. The purpose of the model is to explain individual stock returns during the crash. An obvious variable is the systematic risk variable whose coefficient (as expected from the Capital Asset Pricing Model) should be equal to the average market return for the period One can also use other firm-specific characteristics such as firm-size, leverage, the ratio of book-to-maiket equity, the price-earnings ratio, and foreign listings that explain the decline in different stocks. In the CAPM framework, firm-specific characteristics should not enter into return regressions which are only affected by systematic risk. However, in panic behavior when investors make quick decisions to sell securities, they may use firm characteristics to decide which securities to sell. One may argue that people tend *to* sell the more liquid securities which aie the stocks of larger fums. This claim is also consistent with th; findings of Blume et al. (1990), showing that S&P stocks suffered a higher decline than tion-S&P stocks in the U.S. market, and with Lauterbach and Ben-Zion's (1992) findings for the Israeli market. In addition, using monthly data, Fama and French (1992) daim that firm-specific characteristics eicplain cross-sectional return better than die systematic risk even in normal periods.

Regarding the expected sign of the coefficients, we can make the following comments. The CAPM suggests a strong relation between return and beta, where relatively riskier stocks decline more when the market declines. Panic behavior suggests that the size of the firm is an important variable (the size of a fnn can be a proxy for the liquidity of its stock). Since everyone tries to sell more liquid stocks, the price of these stocks may decline more than the average decline. Foreign listing could also be a factor, if one believes that the world crash is stronger in the country of origin (in our example, the U.S.). In this case, stocks which are traded in the U.S. would decline more at least on the first day.

Another finding of the return behavior during the crash is the overreaction phenomenon where the residuals of equations of consecutive period returns are highly negative correlated. This possible overreaction effect can be estimated by using the previous period's return as an explanatory variable for the current return. A strong negative correlation suggests the possibility of potential arbitrage profit. While a zero correlation is consistent with the efficient market hypothesis, a positive correlation would indicate that the event which led to market decline continued for more than one trading period. The amount of potential arbitrage profit also depends on the magnitude of the reversal coefficient.

On the basis of these arguments, we estimate the following equation:

$$R_t = /(\text{Beta, Size, Foreign Listing, Lagged Returns}) \quad (1)$$

where,

R_t = stock return in pe-iod t,
Beta = systematic risk of the stock,
Size = size of the firm proxied by the natural logarithm of market value of equity,
Foreign Listing = dummy variable to indicate whether or not the stock is traded or U.S. exchanges.

For the analysis of trading volume behavior, we consider two alternate variables in order to measure trading activity. One variable is the turnover ratio which is a fraction of the total number of outstanding shares traded in a given period. Using the turnover

ratio, rather than the trading volume in the number of shares or monetary units, has the advantage of reducing heteroscedasticity. The second variable is the relative turnover ratio where we perform standardization using the average turnover ratio of the first nine months of 1987. The underlying reason is that on a given day the normal turnover ratio of different stocks may be differenl for reasons such as ownership structure, size, riskiness, options availability, etc. By standardization we may possibly reduce the effect of these variables and reveal the mere precise effect of a spec al event, such as the crash.

Based on the literature on trading activity we also relate the volunre of trade to some firm-specific characteristics suci as systematic risk, size, and foreign listing. In addition, we use the absolute vilue of daily returns as a measure of the volatility of security for the period. Finally, we use the lagged values of the turnover ratio *is* an additional explanatory variable since the specifc factors that induce trade of a stock on a given day may influence trading for more than one day.

The estimated regression equation for volume is given as follows:

$$\backslash'_t = /(\text{Beta, Size, Foreign Listing, } AR_{t-k}, V_{t-k}) \qquad (2)$$

where,

V_t = turnover ratio (with two alternative measures) in period /,
AR_t = absolute value of stock retirn in period *t*,
V_t = turnover ratio in period *t*.

IV. DATA

The study considers 114 stocks continuously listed on the Amsterdam Stock Exchange from January 1984 until June 1989. These stocks represent more than 80% of market capitalization of all listed common stocks on the Exchange. The daily adjusted stock prices for the period 1984-1986, which are used to estimate the systematic risk are collected from Datastream. We use the average of all the 114 stocks to calculate the market return (see Kabir (1990) for an additional description of the sample and data). The opening and closing prices during the crash period are collected from the "Officiele Prijscourant" (the official newspaper of the Amsterdam Stock Exchange). The daily returns are calculated as continuously compounded returns. Data on daily trading volume are collected from Stockdata and the financial press ("Officie'le Prijscourant" and "Het Financieele Dagblad"), and data on the number of outstanding shares from the Datastream. All additional data are collected from the same daily Stock Exchange publication.

Regarding the options data, there are 19 stocks for which we have option prices during October 1987. For each such stock we have collected daily series of prices for four call options and four put options for a period of six days around October 19. We have kept the same option, i.e., same exercise price and same expiration date so that we could calculate both overnight return and intraday return on those options. Options that were not continuously traded on all six days were omitted. In total, we have obtained 62 call and 67 put option prices (returns). We have also collected the 'trading volume' of options defined as the ratio of volume traded to open interest.

V. EMPIRICAL RESULTS

Descriptive Statistics

The descriptive statistics of returns and trading volume on the Amsterdam Stock Exchange during the crash period are presented in Tables 1 and 2. Although the major decline in share prices on the ASE, like many other European exchanges was concentrated mostly on the 19th and the 20th of October, the stock market continued to decline until early November. The largest one-day decline was on the 19th of October (R19), and it was almost evenly divided between the overnight (weekend) return (Z19) and the intraday return (Y19). Splitting the total return of the 20th of October (-5.7%) into overnight and intraday returns, we find that the overnight return was -10.3%. It seems that the crash in the U.S. on October 19 had a major effect on the overnight return of October 20

TABLE 1. Descriptive Statistics of Returns

	Mean	St.Dev.	Minimum	Maximum
R15	-2.481	2.416	-10.540	7.440
R16	0.019	2.026	-5.040	12.330
R19	-8.939	6.202	-29.480	0.089
R20	-5.679	6.327	-29.598	6.899
R21	6.023	13.511	-12.430	133.646
R22	-3.477	4.847	-15.847	6.454
Y19	-4.727	4.582	-21.741	1.149
Y20	4.661	£.978	-15.415	40.547
Y21	0.764	o.632	-11.123	14.642
Y22	-4.220	4.428	-17.798	3.509
Z19	-4.212	3.275	-18.232	0.089
Z20	-10.339	£.251	-38.566	1. 869
Z21	5.260	13.317	-12.430	133.646
Z22	0.743	2.949	-10.536	9.685
RW1	-1.730	3.124	-10.610	17.500
RW2	-4.126	3.781	-26.320	2.530
RW3	-13.849	7.735	-31.330	(.800
RW4	-7.181	7.033	-35.490	13.550
RW5	-7.901	6.067	-22.850	5.710
RW6	0.157	6.959	-25.140	13.000
RJS87	2.274	22.870	-60.440	92.340

Notes: The number written next to each variable corresponds to date of Ocbber 1987. Retumvariables R are calculated based on closing prices of subsequent trading days. Variables Z measure overnight return based on close-to-open prices, whilj variables Y measure intraday return calculated on the basis of open-to-close price cf the same day. Variables RW correspond to total return of the week (Monday to Friday) starting from the 5th of October until the 13th of November. RJS87 refers to the otal return of the portfolio of stocks during January-September 1987.

(720) on the ASE. During the trading session of October 20, however, there was a positive intraday return of 4.7%, It is interesting to note that, in absolute value, the overnight returns were twice as much as the trading returns during the first three days of the crash. This is in contrast to Miller's (1989) finding that the variance of overnight returns is far lower than the variance of intraday returns.

Looking at the trading volume data in Table 2, we find that there was a significant increase in volume on Octobsr 19, 20 and 21. While 0.2% of shares were traded on the Exchange between January and September 1987, the number increased to 0.3% on October 19, 0.5% on October 20, and 0.4% on October 21 (see variable TV). The significant increase in trading volume can also be seen by looking at thenumber of shares traded (V) or at the relative measure (RTV). In monetary units, the average daily turnover of shares on the Exchange during the first nine months of 1987 was 614 million guilders. The four-day period during October 19-22 witnessed an increase of turnover to 1.8, 2.6, 1.8 and 1.8 billion guilders, respectively.

There were many transactions and many price changes during these days. For example, the shares of Royal Dutch (probably the most liquid share on the ASE) had 155 sequences of transaction prices on October 16. The number of transactions went up to 360 on the 19th and to 236 or the 20th. Of all the stocks listed on the ASE, 93% declined on October 19 and 79% declined on the following day. Similar proportions are found in our sample. Using overnight and intraday returns, ve find that 89% of the stocks declined on the night between October 19 and 20, and 82% of the stocks increased during the intraday return on October 20.

The descriptive statistics of options are reportsd in Table 3. It is interesting to note thai the return on call option shows a much larger decline on October IS (both on the overnight and intraday returns). The decline in the overnight return of October 19 is relatively small and correction took place in the following session (October 20). This is unlike stocks where the largest decline was the overnight return of October 19. For put options, however, the increase in prices (positive return) starts on October 19 (overnight and intraday return). It continued to the following night (R1920) and the correction in prices, i.e., decline took place in later sessions. We also

TABLE 2. Descriptive Statistics of Trading Volume

	Mean	St Dev.	Minimum	Maximum
V15	40475	108288	0	682297
V16	33095	93807	0	597104
V19	82354	240380	0	1834128
V20	119266	353073	0	2316734
V21	82305	254136	0	2041338
TV15	0.279	0797	0	«.720
TV16	0.209	0431	0	4.150
TV19	0.302	0367	0	1.864
TV20	0.505	0646	0	+.775
TV21	0.390	0.605	0	5.750
RTV15	1.448	4.254	0	45.101
RTV16	1.000	1.124	0	5.559
RTV19	2.040	3.012	0	23.043
RTV20	3.004	3.500	0	22.825
RTV21	2.411	2360	0	14.800
V8486	15561	43369	1	329145
VJS87	20680	53141	1	338043
TV8486	0.268	0.215	0.007	1.285
TVJS87	0.195	0.219	0.003	1.398

Notes: The number written next toeach variable corresponds tothe date in October 1987. Variables V refer tothe number of shares traded on a particular date. Variables TV refer to the turnover ratio (trading volumeexpressed as fraction of total outstanding shares), while variables RTV measure the relatve turnover ratio (fraction of outstanding shares is standardized by the average fraction of Jan.-Sep. 1987).

observe a large increase in the relative volume of trading for put options in the first two days ofthe crash.

TABLES. Descriptive Statistics of Options

	Call		Put	
	Mean	St. Dev.	Mean	St. Dev.
R1516	-1.061	14.263	6.334	14.430
R1616	4.312	16.295	-5.231	10.921
R1619	-33.372	19.505	49.317	25.406
R1919	-38.159	28.475	52.141	27.108
R1920	-7.248	41.273	40.679	29.388
R2020	39.174	49.091	-35.361	23.539
R2021	24.983	30.512	-24.055	16.510
R2121	-8.481	23.117	-0.759	9.862
R2122	-1.995	22.053	6.779	41.448
Vol16	8.691	7.769	7.574	10.661
Vol19	8.£33	9.250	19.783	26.695
Vol20	5.154	5.058	10.879	9.716
Vol21	7.363	10.785	3.369	3.638
Vol22	5.S31	5.872	5.105	5.862

Notes: The number writUn next to each variable corresponds to dates of October 1987. Variables R* refer to returns (overnight and intraday), and variables Vol* refer to the ratio of option volume as a fraction of open interest (expressed in percentage).

Regression Results

The regression results, with daily close-to-dose returns as the dependent variable, ire presented in Table 4. The result for October 19 (R19) indicates that the 9% decline was strongly influenced by systematic risk and size of firms. Riskier and larger firms declined more than did average ones. The phenomenon is consistent with the U.S. experience where larger companies declined more on the first

TABLE 4. Regression Estimates of Daily Returns

	Constant	R_{-1}	R_{-2}	[illegible]	BETA	LMV	VOLUME	F	R^2
R[illegible]	[illegible]	[illegible].018	0.45[illegible]		[illegible]	[illegible]	[illegible]	17.29	0.4[illegible]
	[illegible].380	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]		
R[illegible]	-0.[illegible]	[illegible]	[illegible].[illegible]28	-0.0[illegible]	[illegible].0194	[illegible]34	[illegible].00[illegible]9	0.98	-0.01
	2.24[illegible]	[illegible].24[illegible]	[illegible]	[illegible]224	1.171	1.07[illegible]	[illegible]		
R[illegible]	[illegible]	[illegible].418[illegible]	[illegible]	[illegible]26[illegible]4	[illegible].014[illegible]	0.00[illegible]7	0.0[illegible]1[illegible]	[illegible]	0.48
	[illegible]	[illegible]	[illegible]	1.[illegible]	1.[illegible]	[illegible].[illegible]4	0.[illegible]		
R[illegible]2	0.0[illegible]	[illegible]7[illegible]	[illegible].17[illegible]	0.[illegible]878	[illegible].0091	[illegible]	0.0[illegible]	13.[illegible]	[illegible]
	1.[illegible]94	0.44[illegible]	[illegible].707	1.887	0.[illegible]	[illegible]	0.8[illegible]		

Notes: Vari[illegible] R[illegible] [illegible]ly return based on close-to-close prices. Absolute t values are mentioned below each coefficient. [illegible] ad[illegible] [illegible] ees of f[illegible]

day of the crash, and **gained** more in the recovery, e.g., Blume et al. (1989). A strong **negative** effect is also found for **stocks** which were traded on U.S. exchanges. The returns of October 20 (R20) could not be explained in our analysis by any of the firm characteristics used. This may be due to the opposite direction of the market in the overnight period (-10.3%) and the trading period (+4.7%).

Stock returns of October 21 are mostly characterized by a significant inverse relationship with the returns of the previous two days. This estimated reversal is a cross-sectional reversal rather than a time-series one. In other words, the stocks that declined more than the average on October 19 and 20 had increased above the average on October 21. Most of the above-average losses of these two days were probably recovered on October 21. From the statistical point of view, the reversal coefficients are highly significant, and the level of explanation is rather high. The regression results of October 22 show that larger firms have declined more than the average.

In the sample of options we have data for 62 **calls** and 67 puts for 19 underlying stocks. Here we run the regression explaining the return of an option in a given trading session as a function of returns in previous sessions. The most significant results are obtained from trading on October 20. These are presented in Table 5. In case of both call and put options, we find a significant **negative** coefficient of previous returns which indicates the existence of overreaction in option. In particular, the reversals hold for three previous trading sessions in case of cal options, and two previous trading sessions in

TABLE 5. Regression Results of Option Returns

	Constant	R1516	R1616	R1619	R1919	R1920
Call	-0.06	**+0.10**	+0.15	-0.58	-0.46	-0.98
	(0.63)	(0.32)	(0.55)	(3.11)	(3.86)	(11.17)
Put	-0.01	**+0.26**	**+0.50**	-0.02	-0.24	-0.51
	(0.06)	(1.28)	(1.86)	(0.22)	(2.75)	(6.47)

Notes: The number writter next to each variable corresponds to dates of October 1987. Variables R" refer to overnight or intraday returns. Absolute t values are mentioned below each coefficient.

case of put options. We could not, however, find a significant overreaction in the returns of calls and puts for other trading sessions.

Th; regression results using trading volume are presented in Table 6. In almost all regressions, previous periods' trading activities seem to be the most important explanatory variable. Ising the turnover ratio as a dependent variable, we find that systematic risk influenced the trading volume on October 19 and 20. Firm size had some negative effect on October 20. The dummy variable for U.S. trade was positive and significant only on October 19. In the relative turnover ratio regression, we find that larger firms tended to have higher trading on the 19th of October. Firm size was not significant on other days.

VI. STRATEGY

The basic idea of our strategy is to buy at the opening price (or the c osing price) all stocks whose returns are below the average in a given day, and sell short stocks whose returns are above the average. For simplicity, the investment in each stock is of ;he same magnitude (e.g., NLG ± 1) such that the net investment (and the portfolio beta) is close to zero. We then sell this portfolio at the end of a irading session (e.g., close of the day), or at the beginning of the rext session (e.g., at the opening of the day), or at a later period. One advantage of this portfolio strategy, which combines long and short positions, is that it is not very sensitive to market movements, and the net investment is rather low (an ideal hedging portfolio is a zero-beta portfo io with zero net investment). The argument for designing this strategy is to utilize possible cross-sectional overreaction in the stock market during periods of large price changes.

Fcr illustration, we construct five alternative portfolios, which are selected at four alternative time periods. These are mentioned in Table 7. Portfolio D is selected on the morning of October 19, and held for one period until the cose of trading on the same day, or until the- next morning of October 20, or the end of day October 20, and the morning of October 21 .Similarly, portfolio C was chosen at the dosing hours of Monday, October 19, and held for one period

TABLE 8. Regression Estimates of Daily Trading Volume

	Constant	$(R)TV_{-1}$	$(R)TV_{-2}$	Δr	ΔD_1	ES	LMV	OCTNEW	US	R^2
TV19	-0.0007	0.0651		0.0005		0.0868	0.0008	0.0088	6.75	0.08
	1.85	8.80		0.08		8.-?	1.8	8.331		
TV20	-0.0001	0.8301	0.8209	0.0126	0.0507	0.0 25	-?	0.0 95	18.64	0.43
	0.784	5.05	8.488	1.55	0.071	1.52	*.887	*.290		
TV21	0.005	0.8818	0.0840	0.0001	-0.1	-?.002	-?000	0.0018	8.45	0.18
	8.228	8.518	0.890	0.887	0.80	1.5	0.878	0.2 5		
RTV19	-1.850	1.8 0		-?.2588		0.8818	0.8930	-1.088	8.17	0.84
	1.587	5.488		0.050		0.884	8.871	1.807		
RTV20	0.85	0.585		-?.0054	5.2075	?.4700	0.0 25	0.1 5	0.9751	8.15	0.84
	0.870	5.080	1.187	1.084		0.078	0.38	1.187	0.80	
RTV21	1.082	0.5 5	0.1 52	0.0008	5.5 3	?.5 7	0.8124	0.842	8.18	0.18
	1.	0.4 5	8.187	0.0001	1.31	1.7 5	1.8	0.41		

Note: Variables are the turnover ratio, market index, relative turnover ratio, respectively. ΔT is the change in daily return. Above each coefficient value, the t-value is adjusted for degrees of freedom.

TABLE 7. Return on Selected Porfolios for Different Holding Periods

	Relun used tor selecting portblio	Total invest-ment	Portfolio beta	Holding Period Return (%l One period	Two periods	Three periods	Four periods	Five periods
A	R18+Z20	-2	0.14	52	7.7	8.0	7.9	6.1
B	Z2C	-20	-0.06	4.3	4.8	5.3	5.1	5.0
C	R19	-2	0.18	-3.5	0.4	2.6	2.8	2.8
D	Z1S	-16	0.02	-0.3	0.4	0.1	1.7	1.8
E	Y20	22	-0.01	-OB	-0.6	-0.1	-0.7	–

Notes: See Table 1.

until the morning of October 20. and so on. Portfolios A and B were chosen on the morning of October 20. The choice of portfolio B is based only on the overnight retim. while portfolio A includes also the total return of October 19. Finally, portfolio E was selected at the end of October 20. The results of these strategies for all portfolios arc reported in Table 7.

We can clearly see the potential gain for those who bought a portfolio at the bottom of the crash (morning October 20) and sold at the end of the day or later. The one period return for portfolio A and B was 5.2% or 4%, respectively. The three and five period returns are even higher. Those who bought in the morning or the close of the 19th of October (i.e., before the large overnight decline of October 20) had some loss. The loss was -3.5% for portfolio C and -0.3% for portfolio D. However, increasing the holding period for two more days created positive returns for these portfolios: 2.8% aid 1.8%, respectively. Choosing a portfolio at the end of October 20 (portfolio E) did not seem to create any gain. This may indicate that the market was h less of a panic (i.e., more rational and less overreacting) during the trading day of October 20 than on the previous day. While the gain from this strategy could be eliminated by transaction costs, it is clear that a modified strategy with a smaller number of stocks could be profitable, at least for some periods. On the other hand, it is also possible that one ends up with portfolios still remaining considerably risky.

VII. CONCLUSIONS

The paper analyzes the daily return and trading volume on the Amsterdam Stock Exchange during the October 1987 crash. The results show a large increase in volatility and volume of trade during the week of October 19. It seems that the crash in Amsterdam started in the overnight return (between October 16 and 19) and continued to the morning of October 19 before the major crash in the United States started. This decline may reflect a response to the previous day's decline in the U.S. and Japan. The news of black Monday (October 19) in the U.S. caused an additional overnight drop in share prices in Amsterdam. As for options, we find that the decline was reflected-mostly in call options (approximately 70%) during the overnight and intraday sessions of October 19, and showed not much influence of the event of black Monday in the U.S. Put options had an earlier gain during the overright and intraday returns of October 19, but an additional increase was achieved only after the U.S. decline. We also observe a sharp increase in trading volume for put option? during the crash.

Regarding the deterninants of stock returns, we find that systematic risk played a significant role on October 19, vhile firmsize was also an important determinant during the declining stage of the crash. This is consistent with panic trading where other firm characteristics rather than systematic risk play an important role in investor decisions. Panic behavior also led to a cross-sectional overreaction during the crash. Finally, we have shown that overreaction could be utilized by non-panic investors to make profits from constructing some portfolios.

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